40 Rock

POPULAR Computing WEEKLY

35p 11 November 1982 Vol 1 No 30

This Week

News Desk

Tony Clarke Dragon Data's Managing Director designate

Dragon in forced sale by Mettoy

METTOY the toy manufacturing giant, has been forced to sell its successful Dragon microcomputer development

A six-partner consortium has contributed to create a new company, Dragon Data Ltd The present managing director of Dragon, Tony Clarke, is retained as managing director designate

Mettoy will continue to hold an 18 61 percent interest in Dragon Data

In the last three years Mettoy has accumulated losses of more than £11 5m — resulting from the collapse of its toys business Sale of Dragon — its one profitable subsidiary — is a bitter blow to the company's hopes of an early recovery

Mettoy realises some £900 000 from the deal, which will go to offset losses in the first nine months of 1982 of over £2 5m

See page 5

New games machine from Atari

ATARI has launched a new games machine in the US

Called the Advanced Video Entertainment System (AVES) it was first shown as the Atari 5200 in Chicago in June

The machine is a development of Atari's present VCS system with 16K Ram and improved graphics capabilities It can also reproduce speech and a wide range of games sound effects

Atari spokesman John Dean explained 'Each machine comes with two universal controllers — a combination of joystick, paddle and keyboard They have 360° manoeuvrability and four firing buttons (two on each side)" The AVES features a pause facility, allowing the game in play to be halted and later resumed

The machine is now on sale in America and has been launched with the full range of Atari software

The AVES will be launched in the UK late in 1983 Price has yet to be decided

Classified

Computer Swap 01-930 3266
Free readers entries to buy or sell a computer
Ring 01-930 3266 and give us the details.

SPECTRUM 48K. £180 Tel Wantage 67778

ZX81 2K cassette player + five cassettes + three books £55 ono Tel 061-790 7223

VIC20 cassette deck super expander cartridge and joystick £170 Tel 0274 877657

16K VIC20 – C2M unit, under guarantee also one book £230 ono Tel 0234-46394

HEWLETT PACKARD, HP 41C printer cardreader wand three-memory module three applications module £475 Tel Bognor Regis 864021

SHARP PC1500, colour printer-plotter 8K Ram £275 Tel Bognor Regis 864021

8K PET + Intravel cassette deck, much software including many games £280 Tel 01 940 2077

SINCLAIR ZX81, 16K with power supply leads and box. £60 Tel. Brentwood 216757

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NORWICH NR15 1BB

ZX81 + **16K** + Fuller keyboard books and cassettes All for £75 L Panouk, 42 St Kilda Road London W13

PET 2001 8K, integral cassette and screen with software manuals etc, £200 Tel 01-542 4589 (eves)

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Low cost weekly hire from only 80p. Comprehensive catalogue available FREE, covering games, languages and utilities. New titles are constantly being added. Send stamp for your catalogue now (please state machine)
To KERNOW SOFTWARE LIBRARY
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ZX81 16K plus £30 software £65 ono Tel 0264 64736 (eves/weekends)

Continued on page 28

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We at Silica Shop are pleased to announce some fantastic reductions in the prices of the Atari 400/800 personal computers. We believe that the Atari at its new price will become the U.K.'s most popular personal computer and have therefore set up the Silica Atari Users Club. This club already has a library of over 500 programs and with your purchase of a 400 or 400 computer we will give you the first 100 free of charge. There are also over 350 professionally written games and utility programs, some are listed below. Complete the reply coupon and we'll send you full details. Alternatively give us a ring on 01 301 1111 or 01 309 1111.
ATARI 400 with 16K £199
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400/800 SOFTWARE & PERIPHERALS
Don't buy a T.V. game! Buy an Atari 400 personal computer and a game cartridge and that's all you'll need. Later on you can buy the Basic Programming cartridge (£35) and try your hand at programming using the easy to learn BASIC language. Or if you are interested in business applications, you can buy the Atari 800 + Disk Drive + Printer together with a selection of business packages.
Silica Shop have put together a full catalogue and price list giving details of all the peripherals as well as the extensive range of software that is now available for the Atari 400/800. The Atari is now one of the best supported personal computers. Send NOW for Silica Shop's catalogue and price list as well as details on our users club.
THE FOLLOWING IS JUST A SMALL SELECTION FROM THE RANGE OF ITEMS AVAILABLE
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I am interested in purchasing an Atari 400/800 computer and would like to receive copies of your brochures and test reports as well as your price list covering all of the available Hardware and Software.
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How to submit articles
Articles which are submitted for publication should not be more than 1 000 words long The articles and any accompanying programs should be original It is breaking the law of copyright to copy programs out of other magazines and submit them here — so please do not be tempted

All submissions should be typed and a double space should be left between each line Please leave wide margins

Programs should, whenever possible be computer printed

We cannot guarantee to return every submitted article or program so please keep a copy If you want to have your program returned you must include a stamped addressed envelope

Accuracy
Popular Computing Weekly cannot accept any responsibility for any errors in programs we publish although we will always try our best to make sure programs work

This Week

Editorial

With Christmas fast approaching, many parents will be wondering what presents to buy for their children Microcomputers are likely to figure prominently alongside the more traditional train sets, bicycles and toy soldiers

Children are much more discriminating now than they were even 10 years ago A micro on which they can play PacMan and Space Invaders is far more attractive than blow football or Monopoly, though it is also more expensive

The boom in the micro market has to some extent coincided with a decline in the established toy making industry Meccano is no more and a number of other toy manufacturers are struggling

A few of the more far-sighted toy companies have already branched out into microcomputers and television games centres Mettoy set up Dragon Data as a subsidiary and is already reaping the benefits Mattel has launched its Intellivision system and Phillips has a similar system on the stocks

The result is likely to be a rise in micro sales in the run-up to Christmas Equally important, software houses may find there is an increased demand for their programs

Next Thursday

Can you escape from the Deneb system? How many starships can you destroy? Can you avoid blowing up the universe? Find out in Star Fighter — a new game for the unexpanded Vic20.

Also next week, Tim Langdell presents the first review of the Camputers Lynx — a micro for both home and office

Other features include our regular Spectrum and Dragon pages, our continuing series on machine code and an interview with Tony Clarke of Dragon.

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ZX81 & Spectrum Games

Chess 1.4: Ten levels m/c graphic screen display
16K ZX81 £8 95

Invaders: Very fast m/c action Includes mystery ship and increasingly difficult screens
16K ZX81 £4.45

Mazeman: A fast action m/c game that reproduces the spirit of the original. The Spectrum version includes excellent graphics
16K ZX81 £4 45 – Spectrum £4 95

Adventure 1: Based on the original game by Crowther, this game was the start of the Adventure craze Reviewed Sinclair User issue 2 Features Save game routine as the game can literally take months to complete
16K ZX81 £8 95 – 48K Spectrum £9 95

We have full stock of all programs and supply by return of post (which is included in the price)

SØFTEK

48K 3D MAZENTURE. This fast machine code game is both a 3-D maze and adventure in one. Highly recommended and excellent value for only **£4.95.** (48K Spectrums only)

16K THE ZOLAN ADVENTURE. A full adventure in 16K, probably the best around — only **£4.95.**

NEW!

COMPILER

FOR 48K SPECTRUMS £8 95
— WITH MANUAL —

Ever wished you could wave a magic wand and turn your BASIC program into a machine code one? Now you can! (well almost) The Compiler allows you to write programs using up to 80% of Spectrum BASIC and then turns it into a machine code version in just seconds. Complete with explanatory manual by Tim Langdell!

WRITERS! why not let us market your software for any computer. We pay the highest royalties and market both from London and our office in Los Angeles



Just out from Century/Personal Computer World and available from SOFTEK. Whether you are just beginning or have had some experience with computers Tim Langdell's book is for you It covers everything from an introduction to programming through discussions of graphic art education business uses and games writing to an introduction to machine code and hardware modifications Packed with programs routines and many hints and ideas
£4 95

Send your cheques or postal orders to SOFTEK, 329 Croxted Road, London SE24

Dragon grows on Prutec diet

SALE of the Dragon venture to a six partner consortium will enable an ambitious development programme, planned for the machine, to continue

In the deal, the new Dragon Data Ltd will receive £2 4m in equity and loan stock Ownership of Dragon Data is split as follows Prutec (40 74 percent) the Welsh Development Agency (22 12 percent), Mettoy (18 61 percent), National Water Council, Fountain Development Capital Fund and F & C Enterprise Trust (16 53 percent) and Dragon directors (2 percent)

The company plans to produce more than 200,000 microcomputers in 1983 and the cash will be used to fund the necessary expansion It was this growth that Mettoy could not afford to undertake that prompted the sale

Dragon will now be moving from the Mettoy factory in Swansea to premises provided by the Welsh Development Agency, possibly near Port Talbot Within the next few months the number of staff employed by Dragon — currently 60 — will double

Tony Clark, Dragon's managing director sees a rosy future for the company "Dragon has had a very substantial influx of cash and we shall be taking a great deal of manufacturing and distribution skills with us from Mettoy

At present the printed-circuit boards for the Dragon 32 microcomputer are assembled by Race Electronics in Llantrisant Manufacture of the cases, assembly of the boards and cases, and quality control are all performed by Mettoy

Mettoy will continue to manufacture the plastic mouldings for the machine, but final assembly and testing will now be carried out by Dragon Data

Tony Clarke commented "By the middle of next year Dragon hopes to be able to assemble 50 percent of the printed-circuit boards Mettoy will continue to carry out subcontract work for us in the forseeable future — providing their price is right "

The new line up at the top of Dragon Data will be Tony Clarke (Managing Director), Richard Wadman (Sales and Marketing Director), Derek Williams (Technical Director) and Morris Wilde (Manufacturing and Engineering Director)

Following the sale, Mettoy, which employs more than 2 000 workers, must consolidate its traditional toy interests in an effort to reduce its continuing heavy losses Mettoy retains an option to buy back up to 35 percent share of Dragon in 1984-85

Vic rallies as 64 launch falters

LAUNCH of the Commodore 64 microcomputer has been delayed

It now looks as if the 64 will not go on sale in the UK until at least the middle of December and possibly not until spring next year

The Vic20 will not now be withdrawn, as originally planned, and will continue to be sold in the UK in 1983

More than 1m Vic20s have now been sold worldwide — 800,000 to the US Jack Tramiel predicts that Commodore will sell a further 400 000 Vics in America before Christmas

Still waiting, but listening

IN the past, ringing Sinclair's mail-order company in Camberley has rarely been a pleasurable experience

All that has now changed A machine has now been installed which plays you music while waiting for your enquiry to be dealt with

Among the tunes on offer are Ray Charles singing "I Can't Stop Loving You' and Stevie Wonder singing "Sunshine of My Life'

5th ZX Microfair

DECEMBER 18 will see the Fifth ZX Microfair held once again at the New Horticultural Hall, Greycoat Street London

The show will be open from 10 am to 6 pm For further details contact Mike Johnston, 71 Park Lane Tottenham, London N17

Taking a horizontal view

FOR those who find the 32-character width of the ZX Printer restricting, there is now a solution

Using the software developed by Crommax, it is possible to print lengthways down the ZX Printer paper — rather than widthways Up to 32 lines can be printed, of whatever length defined by the user

The program — *ZX Lprint* — is available on cassette price £3 95 from Crommax, 25 Favart Road, London SW6

BBC goes Forth

LEVEL 9 Computing has announced a version of Forth for the BBC Models A and B microcomputers

The rq Forth compiler is supplied on cassette complete with a 70-page manual A full screen editor is included and 260 primary commands are provided Further functions can — as is usual with Forth — be easily defined

The cassette costs £15 and is available from Level 9 Computing, 229 Hughenden Road, High Wycombe, Bucks

Torch modem approved

TORCH Computers has obtained permission from British Telecom to connect its modem unit to the telephone network

Based around circuit boards manufactured by Acorn, the Torch computer now becomes the first machine to gain such approval

Further information is available from Torch Computers, Abberley House, Great Shelford Cambridge

Sinclair in vouchers mix-up

CONFUSION has arisen over the £10 discount vouchers being given away by Sinclair Research to purchasers of the Spectrum microcomputer

Customers who have ordered more than one machine in the same order have complained that they have received only one voucher

Jaeserv, Sinclair's mail-order company, confirmed this policy Their supervisor commented If more than one machine is going to the same address then the customer will only receive one voucher '

A spokesman for Sinclair Research explained The order processing computer generates one voucher per order If a customer who ordered more than one machine comes back to us — either by telephone or letter — we will send out the balance of the vouchers

"There is absolutely no intention to deceive," he added

Rumbelows' aggressive marketing

RUMBELOWS normally sell the Commodore Vic20 microcomputer for £169 99

But as a special offer they are now selling the machine at £139 99 — providing you part-exchange your old Sinclair computer or tv game As they say in the advertisement, What more could you expect from Rumbelows?

MELBOURNE HOUSE has tied up a deal with the Tolkien Estate to produce an adventure game for the 48K Spectrum featuring characters from the book 'The Hobbit'.

The planned package will include a copy of the book and will go on sale in December



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DUSTCOVERS ARE BUFF — PVC FINISHED — QUALITY

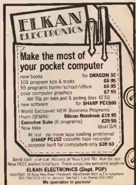
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Exchange and Mart

I wonder if any of your readers can help me to obtain a copy of *Popular Computing Weekly* July 1, as I need this to complete my collection of your magazine

In exchange I can offer a number of my own "video art" programs for the Vic20 with Super expander cartridge

Cpl D P Morgan
24269328
3 Squadron
9 Signal Regiment
BFPO 58

Customer complaints

About two weeks ago I wrote to you, enclosing a copy of a letter I had sent to Clive Sinclair In the letter I complained about the ridiculously long delivery wait for the 48K Spectrum together with the constant misrepresentation by Sinclair about the clearance of the backlog It is now *16 weeks* since my order was acknowledged (which in turn was a further two weeks since it was received) When I rang Sinclair yesterday I was given for the umpteenth time about another three weeks

It is therefore disappointing to find that once again you have fallen into the trap of helping to give credence to Sinclair's *FALSE* propaganda. You reported on page 5 of your September 30 issue the claim that the backlog would be cleared by the middle of October "About three weeks" means, in Sinclair Language, that they *really* have no idea when delivery will take place *Even if* it was three weeks, this would still take it to *after* the middle of October

When you consider that my order was placed at the end of *May* (and there must be hundreds in the waiting list behind me) it is evident that there was never even the *remotest* possibility that the whole backlog would be cleared by the middle of October While I appreciate that you print in good faith information received by you, it must surely be obvious to you by now that Sinclair's utterances are merely intended to mislead people instead of giving the true position By continuing to regularly propagate them, you are yourself in danger of alienating a small proportion of your readership

Michael Hodgkins
3 Rimsdale Walk
Ladybridge
Bolton
Lancashire BL3 4TT

Despite your unfortunate experience, and those of other frustrated Spectrum buyers, I do not think Sinclair's utterances are deliberately intended to mislead people Sinclair has found itself in its current mess by promising a product which it subsequently found it could not deliver within the stated 28 days.

There are a number of reasons why Sinclair is unable to deliver the Spectrum on schedule, mainly technical. Since the beginning, we have reported on the problems Sinclair has had with quality control, the additional 32K Ram and most recently the redesign of the Spectrum's printed circuit board

Sinclair has issued a number of statements on delivery times for the Spectrum Unfortunately, further production problems have meant further delays.

Sinclair is aware of the damage these delays are causing to his reputation, and the fact that he is losing customers to competing manufacturers.

If it is any consolation, the backlog for 16K machines does seem to be shortening. It is largely the 48K customers who are reporting horror story delays of 16, 17 and even 19 weeks.

And he pulled out a plum

Nigel Searle says that Sinclair has tried to respond with letters to aggrieved customers but that it was very difficult

Rubbish!

Further Sinclair has spent an absolute fortune in customer service

Spherical objects!

Facts Since ordering a 48K Spectrum in May, by Teledata, I have received only two letters from the company Neither letter was at all reassuring, helpful or informative and the postal charge, 31 pence, is hardly a fortune Now some 4½ months later, I still await delivery of the machine despite numerous telephone calls to Camberley

Small wonder then, that I am inclined to get annoyed by talk of the delays being over, of the backlog being cleared of excuses like "we didn't think" factory holidays minor production problems Small wonder, then, that Trading Standards Offices up and down the country have Sinclair on their complaints files, that the Advertising Standards Authority is investigating that other consumer interests including the Office of Fair Trading, are becoming involved

Sinclair may be a "technology driven company" However if the company is to remain in business it needs to considerably improve its flagging public image to improve its appalling customer service record both for new sales and for repairs of faults

Mr Sinclair I suggest needs to pull his finger out!

Gerry Luff
19 Charlock Way
Burpham
Guildford
Surrey GU1 1YB

Amplifying Spectrum

I have discovered a very simple method of amplifying the sound output from the ZX Spectrum All you need is your tape recorder and cassette leads, no expensive add-ons are required Simply plug in the microphone lead and disconnect the earphone lead, then remove the tape from the recorder and press the play button All the sounds made by the Spectrum's internal speaker will now be echoed at the recorder's speaker and you can adjust the volume and tone controls There is some background noise caused by the recorder itself, but what do you want for nothing? I use a Prinz TR 225 recorder

On a different subject you announced in the October 14 edition of *Popular Computing Weekly* that Prism are building a new range of software for the ZX81 Could you please tell me how to get in touch with them?

A Laird
9 Franklin Road
Saltcoats
Ayrshire KA21 5AT

Prism Microproducts is based at 30-31 Islington Green, London N1 8BJ (Telephone 01-359 7481)

Antipodean's pleasure

Came across your magazine while browsing about the local newsagent

Being the owner of a ZX81 (with 16K memopak) I promptly purchased the magazine went home and thrashed into the programs there-in

What joy to see so many goodies aimed at the ZX81 computer Most software available here is aimed at the "other mobs"

I have ordered all the back issues, and will continue to collect the future ones Keep up the excellent standard won't you?

PS Letters from readers would be welcome

Kevin Thomas
11 Joan Avenue
Glengowrie
South Australia 5044

Reinventing the wheel

In the correspondence with W McLaren and his cube root program, you are reinventing the wheel Uncle Clive has given us a direct routine for cube or any other roots Just swot up on the laws of indices and use "to the power of" key (shift H)

```
10 INPUT Y
20 PRINT Y**(1/3)
30 GOTO 10
```

The general statement is Y** (1/n) which will give the nth root of Y

Y**−n will give you the reciprocal of Y^n or $\frac{1}{Y^n}$

Y**(−1/n) will give the reciprocal of $\sqrt[n]{Y}$ or $\frac{1}{\sqrt[n]{Y}}$

This facility will also confirm the truth of the statement $Y^0 = 1$, a result which could be disconcerting in the middle of an equation and may prompt some users to complain about a faulty Rom

Les Parselle
Llechryd
Cardigan
Dyfed
SA43 2NR

If you have an opinion you want to express or have spotted an error that needs correcting, write to Letters Popular Computing Weekly, *Hobhouse Court, 19 Whitcomb Street, London WC2*

Radio Log

A directory program for 16K ZX81 by Anthony Briggs

One of the requirements of the amateur transmitting licence is that you should keep a permanent written log of all radio contacts, complete with dates times, callsigns wavelengths etc

Many amateurs, however, keep in addition, a separate card index of contacts so they can tell quickly if a contact is a fresh one QSO was designed as a computer 'card index' which would allow me to

(i) Check to see if a callsign was already logged
(ii) Enter it if necessary with appropriate details, name, town, latest date of contact and other information
(iii) Modify entries as necessary
(iv) Enter a 'backlog' of callsigns at one go
(v) Print a sorted list of all entries

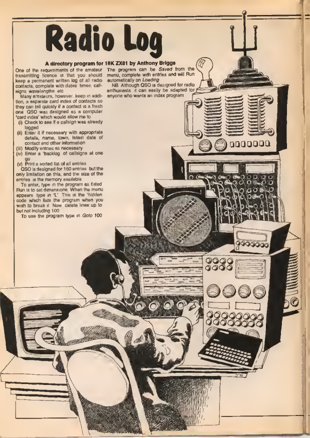
QSO is designed for 150 entries but the only limitation on this, and the size of the entries is the memory available

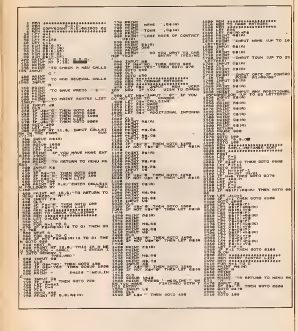
To enter, type in the program as listed Run is to set dimensions When the menu appears type in 'L' This is the 'hidden code which lists the program when you wish to break it Now delete lines up to but not including 100

To use the program type in *Goto* 100

The program can be *Saved* from the menu, complete with entries and will Run automatically on *Loading*

NB Although QSO is designed for radio enthusiasts it can easily be adapted for anyone who wants an index program





```
1 REM ************************
2 REM        Q.S.O.
3 REM COPYRIGHT R.E.GRIGGS 82
4 REM ************************
10 LET A=1
20 LET E=1
30 LET B=100
40 LET C=1
50 DIM A$(B,8)
60 DIM B$(B,10)
70 DIM C$(B,15)
80 DIM D$(B,8)
90 DIM E$(B,25)
100 PRINT AT 6,12;"Q.S.O."
110 PRINT AT 7,12;"[illegible]"
120 PRINT
130 PRINT "TO CHECK A NEW CALLSIGN INPUT         C"
140 PRINT
150 PRINT "TO ADD SEVERAL CALLSIGNS INPUT        A"
160 PRINT
170 PRINT "TO SAVE PRESS   S"
180 PRINT
190 PRINT
200 PRINT "TO PRINT SORTED LIST INPUT   P"
210 INPUT J$
220 CLS
230 IF J$="C" THEN GOTO 460
240 IF J$="A" THEN GOTO 290
250 IF J$="S" THEN GOTO 1980
260 IF J$="L" THEN LIST
270 IF J$="P" THEN GOTO 2000
280 GOTO 100
290 LET A=C
300 PRINT AT 11,0;"INPUT CALLSIGN IN THE FORM              G4O XYZ/M"
310 INPUT A$(A)
320 CLS
330 GOSUB 1600
340 LET A=A+1
350 LET C=A
360 PRINT "IF YOU HAVE MORE ENTRIES INPUT   ""M"""
370 PRINT
380 PRINT "TO RETURN TO MENU PRESS   R"
390 INPUT K$
400 CLS
410 IF K$="M" THEN GOTO 290
420 IF K$="R" THEN GOTO 100
430 IF K$="L" THEN LIST
440 GOTO 390
450 PRINT AT 0,2;"ENTER CALLSIGN FOLLOWED BY            ""NEWLINE"""
460 PRINT AT 16,5;"TO RETURN TO MENU PRESS   R"
470 INPUT F$
480 CLS
490 IF F$="R" THEN GOTO 100
500 IF F$="L" THEN LIST
510 REM *******************
520 REM TO CHECK CALLSIGNS
530 REM *******************
540 LET O=LEN F$
550 CLS
560 FOR A=1 TO C
570 IF F$=A$(A)(1 TO O) THEN GOTO 760
580 NEXT A
590 FOR A=1 TO C
600 IF NOT F$=A$(A)(1 TO O) THEN GOTO 620
610 NEXT A
620 PRINT AT 11,0;"THIS IS A NEW CALLSIGN - SHALL     I ENTER IT INTO MEMORY ?            (YES/NO)"
630 INPUT G$
640 CLS
650 IF G$="NO" THEN GOTO 450
660 IF G$="YES" THEN GOSUB 1600
680 PRINT
690 PRINT "      PRESS "" NEWLINE"""
700 INPUT I$
710 IF I$="" THEN GOTO 700
720 LET A=A+1
730 LET C=A
740 CLS
750 GOTO 450
760 PRINT AT 0,0;A$(A)
770 PRINT
780 PRINT "NAME   ",B$(A)
790 PRINT
800 PRINT "TOWN   ",C$(A)
810 PRINT
820 PRINT "LAST DATE OF CONTACT  ",D$(A)
830 PRINT
840 PRINT E$(A)
850 PAUSE 300
860 PRINT
870 PRINT "   DO YOU WANT TO CHANGE THIS         ENTRY ? (YES/NO)"
880 INPUT M$
890 IF M$="NO" THEN GOTO 920
900 IF M$="YES" THEN GOTO 970
910 GOTO 880
920 CLS
930 GOTO 450
940 REM ********************
950 REM TO CHANGE ENTRIES
960 REM ********************
970 LET M$="INPUT  NEW  VERSION NOW  IF YOU   WISH TO CHANGE"
980 LET N$="INPUT  ""0""  IF YOU DO NOT WISH TO  CHANGE"
990 LET O$="CALLSIGN"
1000 LET P$="NAME"
1010 LET Q$="TOWN"
1020 LET R$="DATE"
1030 LET S$="ADDITIONAL INFORMATION"
1040 CLS
1050 PRINT A$(A)
1060 PRINT
1070 PRINT
1080 PRINT M$,O$
1090 PRINT
1100 PRINT N$,O$
1110 INPUT T$
1120 CLS
1130 IF T$="0" THEN GOTO 1150
1140 IF NOT T$="0" THEN LET A$(A)=T$
1150 PRINT B$(A)
1160 PRINT
1170 PRINT
1180 PRINT M$,P$
1190 PRINT
1200 PRINT N$,P$
1210 INPUT U$
1220 CLS
1230 IF U$="0" THEN GOTO 1250
1240 IF NOT U$="0" THEN LET B$(A)=U$
1250 PRINT C$(A)
1260 PRINT
1270 PRINT
1280 PRINT M$,Q$
1290 PRINT
1300 PRINT N$,Q$
1310 INPUT V$
1320 CLS
1330 IF V$="0" THEN GOTO 1350
1340 IF NOT V$="0" THEN LET C$(A)=V$
1350 PRINT D$(A)
1360 PRINT
1370 PRINT
1380 PRINT M$,R$
1390 PRINT
1400 PRINT N$,R$
1410 INPUT W$
1420 CLS
1430 IF W$="0" THEN GOTO 1450
1440 IF NOT W$="0" THEN LET D$(A)=W$
1450 PRINT E$(A)
1460 PRINT
1470 PRINT
1480 PRINT M$,S$
1490 PRINT
1500 PRINT N$,S$
1510 INPUT X$
1520 IF X$="0" THEN GOTO 1540
1530 IF NOT X$="0" THEN LET E$(A)=X$
1540 CLS
1550 GOSUB 1940
1560 PRINT "PRESS "" NEWLINE "" WHEN YOU HAVE      FINISHED WITH THIS ENTRY"
1570 INPUT L$
1580 CLS
1590 IF L$="" THEN GOTO 450
1600 REM ********************
1610 REM TO MAKE ENTRIES
1620 REM ********************
1630 LET A=C
1640 LET A$(A)=F$
1650 PRINT A$(A)
1660 PRINT
1670 PRINT "INPUT NAME (UP TO 10 LETTERS)"
1680 INPUT B$(A)
1690 CLS
1700 PRINT B$(A)
1710 PRINT
1720 PRINT "INPUT TOWN (UP TO 15 LETTERS)"
1730 INPUT C$(A)
1740 CLS
1750 PRINT C$(A)
1760 PRINT
1770 PRINT "INPUT DATE OF CONTACT IN THE    FORM 01/08/82"
1780 INPUT D$(A)
1790 CLS
1800 PRINT D$(A)
1810 PRINT
1820 PRINT "INPUT ANY ADDITIONAL INFORMATION (UP TO 25 LETTERS)"
1830 INPUT E$(A)
1840 CLS
1850 PRINT A$(A)
1860 PRINT
1870 PRINT B$(A)
1880 PRINT
1890 PRINT C$(A)
1900 PRINT
1910 PRINT D$(A)
1920 PRINT
1930 PRINT E$(A)
1940 RETURN
1950 PAUSE 300
1960 CLS
1970 GOTO 100
1980 SAVE "Q.S.O"
1990 GOTO 100
2000 REM ********************
2010 REM SHELL-METZNER SORT
2020 REM ********************
2030 FAST
2040 LET F=1
2050 LET G=C
2060 IF 2**F>G THEN GOTO 2090
2070 LET F=F+1
2080 GOTO 2060
2090 LET N=2**F-1
2100 LET M=INT (M/2)
2110 IF M=0 THEN GOTO 2370
2120 LET I=G-M
2130 LET J=1
2140 LET F=J
2150 LET K=F+M
2160 IF A$(F)>A$(K) THEN GOTO 2200
2170 LET J=J+1
2180 IF J>I THEN GOTO 2100
2190 GOTO 2140
2200 LET Y$=A$(F)
2210 LET A$(F)=A$(K)
2220 LET A$(K)=Y$
2230 LET Y$=B$(F)
2240 LET B$(F)=B$(K)
2250 LET B$(K)=Y$
2260 LET Y$=C$(F)
2270 LET C$(F)=C$(K)
2280 LET C$(K)=Y$
2290 LET Y$=D$(F)
2300 LET D$(F)=D$(K)
2310 LET D$(K)=Y$
2320 LET Y$=E$(F)
2330 LET E$(F)=E$(K)
2340 LET E$(K)=Y$
2350 LET F=F-M
2360 IF F<1 THEN GOTO 2100
2370 SLOW
2380 REM ********************
2390 REM PRINT SORTED LIST
2400 REM ********************
2410 FOR N=1 TO C
2420 PRINT A$(N)
2430 NEXT N
2440 PRINT
2450 PRINT
2460 PRINT "TO RETURN TO MENU PRESS  ""M"""
2470 INPUT Z$
2480 IF Z$="M" THEN GOTO 2500
2490 GOTO 2470
2500 CLS
2510 GOTO 100
```


Neil Hooper with his array of signal processing machines.

From the Bachelors to Bug-Byte and Bach

***David Kelly** talks to Neil Hooper of the Tape Duplicating Company*

Every prospective software company has come up against this problem at some time or another. You have just written the best computer program on the planet. Now what do you do with it?

If you want to sell it, it will need to be copied. There are surprisingly few companies that have the facilities to produce large quantities of computer cassettes — one of these is the Tape Duplicating Company based in Islington, London. They handle work for many of the major companies and November will see them produce close on ¼m software cassettes.

Yet it is only by a series of happy accidents that they have come to be involved in this type of work at all.

Neil Hooper runs their computer division. After leaving school he joined Barclays Bank. Posted to Cross Keys in South Wales he soon became restive. Moving jobs, he worked first as a disc jockey at Tiffany's in Rotherham and then as a writer for the IPC *Melody Maker* spin-off *Musicians Only*. This job only lasted 18 months before the publication folded, and he found himself without work.

Neil lived quite close to Tape Duplicating. He just wandered in one day and they offered him a job on the strength of his knowledge of the music business.

At this time Tape Duplicating did no computer work. That side of things started in November 1981. Explains Neil: "John Patterson of Silversoft just came in off the street and said 'Do you copy microcomputer cassettes — I found you in yellow pages'.

"My first reaction was enthusiastic. It was just luck. I was, at that time, the only person in the company who was a microcomputer enthusiast. A friend on *Musicians Only* had introduced me to his Tandy Level 1, and ever since then I had been hooked. I told John that we'd have a go.

At this point there were no ground rules for duplicating software cassettes. Up until then the UK home computer market had been a cottage industry.

"The ZX81 was our entry," says Neil. "People we talked to said if you could get less than a 25 percent rejection rate then

Cutting out and loading

you were doing well. This horrified me. I thought 'If we can't do better than that then we don't want to know'."

Neil agreed to do some trials with the tapes supplied by Silversoft and the results were encouraging. This was in November in the height of the audio season and everything was jumping for Christmas 1981. So any further plans were shelved until the New Year. In January the company bought a ZX81 and a Ram pack.

When we looked at whether we wanted to get into computer tape duplication we discovered that we were ideally set up to do it," says Neil. "We had the right equipment — purely by chance. With very little adjustment we could improve our tolerances to the necessary levels. If we hadn't been able to do it so easily I don't suppose we would have got into it — now is not the right time to start a huge investment in machinery — particularly then, for a market which at that time did not even exist.

"These days we do quite a lot of signal processing to ensure the quality of our recordings, and our record is pretty well perfect. Now that the market is increasingly retail orientated, our customers have to be sure we will do a good job because quite often the tapes go straight into distribution after leaving our factory.

"We do work for most of the well-known companies, 51 in total — including Quicksilva, Bug-Byte, Commodore, Sinclair and Grundy. So far we have done 226 cassette programs of all types — games, business packages and utilities. But we had another four masters in this morning. The equipment we have means we can cope with programs for the ZX81, Spectrum, Vic20, Dragon, NewBrain, Commodore 64, Tandy, Sharp and almost anything else. We can do the Atari, but it is a small market since most of the software is Rom based."

Tapes are copied end-to-end, recorded many times on reels of cassette tape over 1½ miles long. The recorded reel is then cut into the cassette cases after recording. This is better than in-cassette copying where recording takes place after the tape has been loaded into the cases. The recording takes place at many times the normal playing speed and in-cassette copying is of inferior quality because the cassettes are not designed to operate smoothly at high speeds.

Computer tape duplicating brings its own special problems. But it does have the advantage that the frequency range of the computer signal is in a narrow region — up to 3 or 4 KHz (a typical audio signal could be as high as 16KHz.) A disadvantage is that the tape quality has to be high. Tape drop-out — small imperfections in the magnetic coating of the tape — which would be tolerable on an audio cassette, are unacceptable on a computer tape.

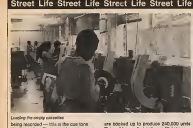
The duplicating process has nine steps:

(1) Signal processing. The computer program is dumped from the tape supplied by the software house on to ¼" tape.

At this stage the signal is processed so that after duplicating the wave-form will be suitable to allow easy loading of the program. Domestic recorders are often badly aligned, so the loading process must be made as uncritical as possible.

(2) Mastering. The ¼" tape is copied on to a 1" master.

(3) Master loop. The 1" master is formed into an endless loop by joining the ends together. The 1" loop is loaded into 1 of 5 master recording units and is driven round at 240" per second. The output is then used to record on to the cassette tape. A typical computer program master is run through the master unit's play heads once every 5 to 10 seconds. Each time the join in the tape comes round a small audio blip is transferred on to the cassette tapes



Loading the empty cassettes

being recorded — this is the cue tone

(4) Recording The output from the master recorder is transferred to up to 14 slave units These carry the cassette tape in the form of 'pancakes' 6 500 feet long The cassette tape is run at 64 times the normal playing speed and more than 150 duplications are made every minute

(5) Checking recording From each batch of pancakes recorded the first one is checked to ensure that the slave has been correctly set-up and the recording level is verified

(6) Checking loading This last recording from the pancake is then cut out into a cassette case and the loading characteristics of the tape on the computer are checked

(7) Cutting out If these two quality checks are passed the pancakes are taken downstairs to be cut out into the cassettes Here the tape from the pancake is married with what are called C0s — cassettes containing only leader. The leader is drawn part across the cassette, is cut and one program length off the pancake is spliced and wound in. The sections are cut off the pancake using the tones (put on by the gap in the master) to determine the beginning and end of each recording

(8) Printing The completed cassettes are stamped with the name and details of the program

(9) Packing Finally, the cassettes and card inserts are placed inside the cassette boxes

Most computer cassettes are either C6 or C10 cassettes (3 or 5 minutes per side) It costs 33p plus VAT per C10 cassette duplicated with a minimum order of 500 units For orders of less than 1000 there is a small charge for mastering and for printing on to the cassette The minimum charge is than £207 with a turn-round time of 4 to 5 days

Tape Duplicating does not involve itself in the printing or production of the loose card inserts or packing In many cases the packaging costs more than the cost of the cassette and duplication

In January this year says Neil, "we were duplicating perhaps 1000 computer cassettes per month This November we are cooked up to produce 240,000 units This will be our first software Christmas

"Duplication of computer cassettes now takes up more than 10 percent of our work. The *Personal Computer World* show was ridiculous — we are still getting a flood of orders as a direct result of our being there

Recording on a bank of slave units

"The reason is that software is the key to a machine s success Without software a microcomputer will not sell Look at the Dragon for example So many people are writing for that machine that its future looks assured We have something like 15 companies that hope to do Dragon cassettes through us at the moment

"Confidentiality is obviously very important Most companies who launch a new machine want some software to be released at the same time Consequently, we get a pretty good picture of what everybody is planning for the next six months So obviously secrecy is vital to our continued business and good relations That puts us firmly on the inside of the industry and — quite incidentally — helps us to plan what we should be doing

"We have constantly to keep an eye open for pirates So far we have only had one case of someone else's tape being presented to us for duplication and in fact it turned out to be perfectly legitimate There are so few good programmers that it has reached the point where I can recognise their styles — and tell who wrote a program just by looking at it — like a fingerprint

Piracy

"Piracy of our own cassettes is something we cannot really stop — we can make copying difficult — but not impossible But it will only become a serious problem when the pirated copies start being marketed in any real quantities This is almost certainly starting to happen

"We are also exporting more and more material A lot of Vic cassettes go overseas and more and more of our ZX81 titles also say TS1000 $1.00 per tape is the figure that I have heard quoted for tape duplication in the US and our prices are competitive with that

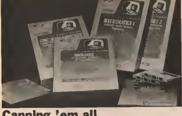
"Quite what will happen to the UK market is still very uncertain Hopefully the current boom will carry through to February next year as people buy software for the machines they received at Christmas

"It is such a new market that there is no established seasonality yet — the machines haven't all arrived — the Lynx and Oric are still on their way and who knows about the Binatone — and the structure of the market hasn't settled down I hope it will by next year Staying one jump ahead is wearing me out





Master loop (foreground) used to record on to slave units



Capping 'em all with Mastermind

***Mike Grace** cuts his teeth on three of Commodore's latest Vic20 programs*

The introduction of the microchip into the home has received considerable publicity. While the computer hobbyist still buys his machine primarily to learn programming or play games, there is still a vast untapped market of people who do not want to spend all day zapping asteroids or munching blue meanies and who are just a little bit frightened of the idea of a machine that talks back — yet feel perhaps there will be a future for a computer in their home.

This market is big money, when compared with the hobbyist. There comes a stage when the appropriate software needs to be created to persuade this market to part with its money and purchase the hardware. Educational programs might seem to be the answer, satisfying the justification for Dad to actually buy that machine, which he hopes he will have time to play with, because he can persuade everyone that it is a *good thing* as it will help the children to learn more.

Commodore has come up with some new programs with fairly toned down covers, unlike the more lurid and eye-catching games, which are aimed specifically at the educational application of the Vic20. There are two main varieties at the moment — the GCE Revision programs, including subjects such as English Language, Biology, Physics, Chemistry and Mathematics, and the Home Software range which includes quizzes and games for the family and subjects like Money Manager (the often-maligned cash flow/bank balance program) and the Robert Carrier Family Menu Planner (the cookbook database).

All the programs are cassette-based, all require either 8K or 16K expansion, and all are neatly packaged in strong cardboard boxes which contain a superbly written booklet plus two cassettes tidily contained in plastic and easily removed from their packaging. The boxes open with a hinged lid. I was impressed with the style and quality of the packaging which, for the price (£9.99), seemed to be well above average. Ten pounds seems to be good value for money when compared with most other software around. But is it value for what you get?

The three programs I was sent for review were *Mastermind*, *Quizmaster* and *English Language Revision*. As all were basically the same in performance, I will start by describing *Mastermind* in some detail and then compare the other two.

At this stage I should point out that all these programs come from the combined talents of Commodore and the Ivan Berg Software house. I hope that this marriage continues, as I believe there is tremendous scope for the future. However, I also feel there are some flaws in the existing concepts which I shall come to in a moment.

Mastermind looks the most appealing program and I thought would be the best of the three, with a picture of the famous Mastermind chair on the cover of the box

Ivan Berg with Vic20 and Commodore/Ivan Berg software

and the weight of the BBC behind it On opening the instruction booklet there is a short introduction plus an even shorter summary of the game itself, for anyone living in a cave who may not be familiar with the idea

The instructions really are excellent assuming absolutely no knowledge of how to load programs yet displayed in a manner that allows the seasoned player to skip swiftly through the elementary advice For each major segment of the loading instructions there is a clear photograph of the screen display All my children dealt swiftly and easily with this section

As I mentioned these programs are cassette-based, and it was here that I found the first problem — the loading time In the booklet mention is made of this with the rather glib statement that the 1½-2 minutes it takes to load "adds to the tension and excitement." It might work with the first game, but after that it becomes tedious While it makes sense to produce cassettes for the mass market, it would be nice to incorporate into the program the facility to save on disc both the main program (which of course you can if you have your own disk drive) and the data

Once loaded, the Vic blurts into life by playing a short snatch of electronic music Although the book told me this was the well-known *Mastermind* theme I could not recognise it Still It only lasts about three seconds And then we are into the game itself

The idea is to copy the television game The Vic takes the part of Magnus Magnusson and asks the questions Each player must type in his answer and get through as many questions as possible in two minutes

"I found the level of questions difficult to assess . . ."

There are several other data types available which allow participants to select topics such as Sport and Games, Music, Films and TV as their specialist subjects The introductory kit comes with a tape which contains Science and Technology on one side and General Knowledge on the other As the game is designed for up to four players, it would seem advisable to purchase the extra tapes At £1 99 for each tape the cost of a complete package comes nearer to £25 (there are eight extra data tapes at the moment)

Quizmaster follows the same format as *Mastermind* but this time you can construct and set your own questions Once again there is a main operating cassette which loads the program, and a data tape which contains a sample test quiz to show how it is done But you also have the option of entering a menu which will allow you to devise set edit and save your own quiz And this time the total cost is £9 99

In all these quizzes there are three main types of questions a multiple choice true or false, or matched answer As you devise your own quiz you are free to select any of the three types The Vic asks you to set the question, type the answer and select an appropriate score out of 100 With each quiz you have a maximum of 40 questions (which is no problem as I found it quite difficult to think of 10 at first) Having started on the quiz, you can save it at any stage and come back to it later

What appealed to me about this program was that I could set whatever question I liked For example I have already created a quiz to test my five-year-old on his spelling and his multiplication tables

The problem with *Mastermind* was the lack of sufficient data Quite often the same question would be randomly thrown up during the same game — giving one player an unfair advantage To be fair we were playing with the one data tape and so were quite restricted but this is a definite snag

In *Quizmaster* there is a clock display ticking away the seconds as you go through the quiz, but this is missing from the screen in *Mastermind* Quite a serious omission from the excitement of the game I would have thought

The final program I tested was the GCE *English Language Revision* Obviously this time the questions are more specialised and the knowledge of a slightly higher standard The booklet gives what I can only describe as short notes of guidance (difficult to see how to fit in the entire GCE syllabus in 5½ pages) The questions seemed to be very limited in scope as they are based on the notes in the booklet

I found the level of questions difficult to assess as I am not a teacher but I can imagine it would be a useful adjunct to a child who was finding a certain subject quite difficult For most children, however, I feel it would have only limited value

In summary then I am pleased that Commodore is launching into the expanded software scene All three programs were well written, well presented and appeared bug-free Each game comes with one cassette containing the operating software recorded twice on each side of the tape (surely a slight overkill of the belt and braces concept) in case of loading problems *Mastermind* is the best game in the light of family playing, but I feel is overpriced for the scope available However the cost of £2 a cassette for more data seems very reasonable The GCE revision program is also well presented but requires self-discipline At £10 I think it is good value if your child finds that topic difficult, as it does make learning a little more enjoyable, but if your child is good at the subject I suspect it would quickly pall

For my money *Quizmaster* is easily the best of the three It contains simple advice on how to set up your own quiz which can be as easy or hard as you wish, cover whatever topic you choose, act as a game for the family and allows you to change the data whenever you want

My biggest complaint about all the programs was their inherent ability to bring home to me just how ignorant I am It is perhaps a little distressing to find *Mastermind* has given me 3 out of 20 questions right In fact I think I'll just collect the family together again and we'll have another game

Open Forum

Open Forum is for you to publish your programs and ideas
It is important that your programs are bug free before you send them in. We cannot test all of them.
Contributions should be sent to Popular Computing Weekly, Hobhouse Court,
19 Whitcomb Street, London WC2H 7HF.

How to contribute

Each week the editor goes through all the programs that you send to Open Forum in order to find the Program of the Week.

The author of that program will qualify for DOUBLE the usual fee we pay for published programs. (The usual fee is £5.)

Presentation hints

Programs which are most likely to be considered for the Program of the Week will be computer printed and accompanied by a cassette

The program will be well documented, the documentation being typed with a double spacing between each line

The documentation should start with a general description of the program and then give some detail of how the program has been constructed and of its special features

Listings taken from a ZX Printer should be cut into convenient lengths and carefully stuck down on to white paper, avoiding any creasing.

Please enclose a stamped, self-addressed envelope.

Screen $

on ZX81

This is a machine-code version of the ZX Spectrum's *Screen* $(Y,X) function for the ZX81

My function returns the code of the character situated at Y,X on the screen. With this function basic versions of games such as Pacman can be reproduced with a more realistic running speed. Also Spectrum games containing *Screen* $(Y X) may be converted to the ZX81

To use the function in your programs type in program A and run it. Now delete all but line 1. Now type in program B and the rest of your program. When you wish to find the contents of Y X just *Gosub* 9000 and the answer will be in L.

For those just learning machine-code I have included a detailed list of how the code works. This function takes about 1/50th of a second to complete

ADDRESS	*HEX CODE*	*INSTRUCTION*	*BASIC*
16514	00	—	X stored here
16515	00	—	Y stored here
16516	218240	LD HL,16514	LET HL = 16514
16519	4E	LD C,(HL)	LET C = PEEK HL
			ie LET C = X
16520	0600	LD B,0	LET B = 0
			so BC = X
16522	2A0C40	LD HL,(D F)	LET HL = PEEK 16396
			ie HL start of Memory Map
16525	23	INC HL	LET HL = HL + 1
			ie first square on screen
16526	09	ADD HL,BC	LET HL = HL + BC
			ie LET HL = HL + X
16527	E5	PUSH HL	Store HL
16528	218340	LD HL,16515	LET HL = 16515
16531	5E	LD E,(HL)	LET E = PEEK HL
			ie LET E = Y
16532	1600	LD D,0	LET D = 0
			ie DE = Y
16534	210000	LD HL,0	ie LET HL = 0
16537	0621	LD B,33	LET B = 33
16539	19	ADD HL,DE	LET HL = HL + DE
			ie HL = HL + Y
16540	10FD	DJNZ - 1	If B < > 0 then LET B = B - 1 and go to 16539
			ie Multiply Y by 33
16542	44	LD B,H	LET B = H
16543	4D	LD C,L	LET C = L
16544	E1	POP HL	LET HL = HL that was stored
16545	09	ADD HL,BC	LET HL = HL + BC
			ie HL = HL + (33 * Y)
16546	4E	LD C,(HL)	LET C = PEEK HL
			so C contains code of character at Y,X on screen
16547	0600	LD B,0	LET B = 0
16549	C9	RET	RETURN

On *Return* from machine code *Usr* 16516 = contents of BC so *Let* L = *Usr* 16516 means *Gosub* 16516 and *Let* L = BC, but BC = code of character at Y,X on screen so L = code at Y,X on screen

Program A

```
1 REM (36 ZEROs)
5 LET X = 16514
10 LET A$ = "00002182404E0600"
11 LET A$ = A$ + "2A0C402309E5218340"
12 LET A$ = A$ + "5E160021000006211910FD"
13 LET A$ = A$ + "444DE1094E0600C9"
20 POKE X,16*CODE A$ + CODE A$(2) - 476
30 LET X = X + 1
40 LET A$ = A$(3 TO )
50 IF A$ = "" THEN STOP
60 GO TO 20
```

Program B

```
9000 POKE 16514,X
9001 POKE 16515,Y
9002 LET L = USR 16516
9003 RETURN
```

by Bill Henderson

High-res characters

on Dragon

This short routine displays the character set which is available in each high resolution mode on the Dragon. The screen is filled with each character before the next character is displayed

Program notes

Lines	
10	Reserves space for the machine code routine
20	Clears the screen, start sets the start address for the machine code routine
30 to 50	The routine to display the character is poked into storage
60 to 90	These lines alter the high resolution mode and the colour set
100	The machine code routine

A description of the machine code routine is given below

Lines	
86 00	LDA #0 — Pick up first character to be displayed
8E 06 00	LDA #0 — Load index reg X with offset 0
A7 89 06 00	STA 0600,X — Store the character at offset X from the top of the screen
30 01	LEAX 1,X — Increment X by 1
8C 18 00	CMPX #1800 — Is the screen full
25 F5	BLO - 11 — Loop until 4 pages full
4C	INCA — Increment character
26 EF	BNE — Continue until all characters have been displayed
39	RTS — Return to the calling program

```
10  CLEAR 100,16383
20  CLS : S=16384
30  READ X
40  IF X <> -1 THEN POKE S,X : 3=S+1 : GOTD 30
50  FOR PM=1 TO 4 : PMODE PM,1 ' PCLS
60  FOR SC=0 TO 1 : SCREEN 1,SC
70  EXEC 16384
80  NEXT SC,PM
90  END
100 DATA 134,0,142,0,0,167,137,8,0,48,1,140,
         24,0,37,245,76,38,239,37,-1
```

High-res characters

by Howard Law

turn to page 18

Attenuators

on ZX81

Attenuators is a program which requires about 1,400 program bytes of memory on a ZX81 The program calculates and prints the results in table format of resistive attenuator networks which are a basic part of any physics A level course

In practice t- and pi-network resistive attenuators or matching pads (Fig 1) are designed to give some convenient voltage ratio which may be stated in decibels even though the input and output impedances are different. The attenuation figures in decibels used in the program are those equivalent to 20log (Ein/Eout)

Each type has its subtle advantages and disadvantages The pi-type for example will dissipate power through all three resistors in case of no load, the t-type only through two resistors

Attenuators giving more then 20dB loss and pads with high Rin/Rout ratios are usually built up of two or more basic networks in cascade

For each pair of cascaded pads make sure the output impedance of the first network is the same as the input impedance of the second network Where a more permanent connection is intended, the two adjacent elements may be combined in a single resistor to form a ladder network as shown in Figs 2 and 3

Any number of steps may be used in order to build up the required attenuation For balanced networks the values of the series elements are half those for the basic t- or pi-attenuator, as shown in Fig 4

If for a certain calculation with unequal Rin and Rout negative resistor values are obtained, then the chosen Rin/Rout ratio is too high Try cascading to achieve the desired impedances. Run program and enter data as asked for on screen If lists are longer then screen can hold press *Copy* for a permanent record and press *Cont* for the rest of the results

This is a very convenient way to interpret and check the results before they are printed On the other hand one could change the *Print* statements from line 160 through to line 430 and obtain immediate hardcopy by inserting *Lprint* statements

Line 470 prevents the program list being displayed after each *Run* If higher than 1 ohm resolution is necessary the real values for R1 R2 etc would have to be printed instead of integer values

Program notes

Line(s)	
8 to 140	select t or pi-network Enter input and output impedances Enter table limits
150	speeds up calculations
160 to 270	print appropriate headings
280 to 290	define table parameters in *For-Next* loop
300	decibel conversion
310 to 370	t-pad formula
380	prints rounded integer value t-pad results
390	part of t-pad table loop
400 to 420	pi pad formula
430	prints rounded integer value pi-pad results.
440	*Next* table loop
450	prevents loss of sync on new data entry
460	program stops press *Cont* for new calculations and results.
470	starts again with data entry



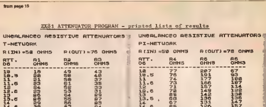
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from page 15



ZX81 ATTENUATOR PROGRAM - printed lists of results

UNBALANCED RESISTIVE ATTENUATORS

T-NETWORK

R(IN)=50 OHMS R(OUT)=75 OHMS

ATT. DB	R1 OHMS	R2 OHMS	R3 OHMS
10	18	49	43
10.5	20	50	40
11	21	50	37
11.5	23	51	35
12	24	52	33
12.5	25	53	31
13	26	54	29
13.5	28	55	27
14	29	56	25
14.5	30	57	24
15	31	57	22
15.5	32	58	21
16	33	59	20

UNBALANCED RESISTIVE ATTENUATORS

PI-NETWORK

R(IN)=50 OHMS R(OUT)=75 OHMS

ATT. DB	R4 OHMS	R5 OHMS	R6 OHMS
10	77	207	87
10.5	76	191	93
11	74	177	100
11.5	73	166	107
12	71	157	114
12.5	70	149	122
13	69	142	130
13.5	68	136	138
14	67	131	147
14.5	66	126	157
15	65	122	167
15.5	64	118	177
16	63	113	186

ABOVE: ZX81 copy of printout for T- and PI-networks with unequal input and output impedances.

BELOW: ZX81 copy of printout for T- and PI-networks with equal Rin and Rout.

UNBALANCED RESISTIVE ATTENUATORS

T-NETWORK

R(IN)=600 OHMS R(OUT)=600 OHMS

ATT. DB	R1 OHMS	R2 OHMS	R3 OHMS
1	35	35	5208
1.5	52	52	3457
2	69	69	2583
2.5	86	86	2056
3	103	103	1703
3.5	119	119	1449
4	136	136	1258
4.5	152	152	1108
5	166	166	987
5.5	184	184	887
6	199	199	803
6.5	215	215	732
7	229	228	672
7.5	244	244	615
8	258	258	566
8.5	272	272	526
9	286	286	487
9.5	299	299	453
10	312	312	422
10.5	324	324	393
11	336	336	367
11.5	348	348	344
12	359	359	322
12.5	370	372	300
13	380	382	283
13.5	391	391	266
14	400	402	249
14.5	410	412	234
15	419	419	222
15.5	428	426	207
16	436	436	195
16.5	444	444	184
17	451	451	173
17.5	459	459	163
18	466	466	154
18.5	473	473	145
19	479	478	136
19.5	485	486	129
20	491	491	121

UNBALANCED RESISTIVE ATTENUATORS

PI-NETWORK

R(IN)=600 OHMS R(OUT)=600 OHMS

ATT. DB	R4 OHMS	R5 OHMS	R6 OHMS
1	10435	10435	69
1.5	6966	6966	104
2	5235	5235	139
2.5	4195	4196	175
3	3509	3509	211
3.5	3016	3016	248
4	2652	2652	286
4.5	2365	2365	325
5	2142	2142	365
5.5	1956	1956	405
6	1806	1806	448
6.5	1676	1676	492
7	1569	1569	536
7.5	1475	1475	586
8	1394	1394	634
8.5	1323	1323	685
9	1262	1262	739
9.5	1204	1204	795
10	1155	1155	854
10.5	1111	1111	915
11	1071	1071	980
11.5	1035	1035	1048
12	1003	1003	1119
12.5	973	973	1194
13	946	946	1273
13.5	922	922	1356
14	899	899	1444
14.5	878	878	1536
15	860	860	1634
15.5	842	842	1737
16	826	826	1845
16.5	811	811	1960
17	797	797	2081
17.5	785	785	2212
18	773	773	2345
18.5	762	762	2489
19	752	752	2640
19.5	742	742	2802
20	733	733	2978

REFERENCE: Marconi Instruments, "Useful Data", page 285

Attenuators
by D Fritsch

World Map

on Vic20

The program produces a map of the world in high resolution graphics for the unexpanded Vic20. I think that it really does show all Vic owners what these basic machine can do considering the limited amount of *Ram* that it has.

The program plots a map of the world with a title printed above it which takes up about half of the screen.

The program is written in three parts and starts off with the setting up of the high-resolution screen, then comes the main body of the program consisting mainly of *Data* statements for the X,Y co-ordinates of the display and finally the point-plot subroutine.

The program starts off by copying 8K of the characters that are necessary for the display from *Rom* to *Ram* memory locations which start at 6144 and go up to 7679; this is so that any changes that have to be made to the characters for the display can now be made (characters cannot be touched while in *Rom*). Memory pointers are also set in this line (line 10) by *Poking* 52,24 and 56,24. This means that the character information now comes from *Ram* where the copied characters are stored.

Line 15 prints the title and sets the screen and border colours. Line 20 lays out the high-resolution area of the screen by *Poking* the characters from 64 to 191 on to the screen. So that the title could be printed the characters from 0 to 63 were also copied into *Ram* (these are the normal letter characters etc). The title was only included in the display to show the use of both high-resolution and ordinary characters on the screen at the same time.

The next thing that the program does is to turn all of the characters which are to be used for the display (ie 64 to 191) 'off', that is, to set their memory locations to zero. This is done in line 25.

The next part of the program consists mainly of *Data* statements for the X,Y co-ordinates for the subroutine at lines 200 to 210. These lines calculate which memory location requires changing and then *Pokes* that memory location so that a 'pixel' is turned on (there are 8 × 8 pixels in every character).

The program takes about three minutes to complete the display because it is run in Basic, so to speed up the program it is best run with machine code subroutines (if memory space allows). The user of the program can delete all of the lines from 30 to 199 which leaves him with about 1600 bytes to write his own program which plots whatever he likes as long as he is within 127 × 63 on the X,Y co-ordinates (size of high-resolution area).

PROGRAM OF THE WEEK

```
10 T=6144 S=32768 FORI=0TO1535 POKEI+T,PEEK(I+S) NEXT POKE52,24 POKE56,24
15 PRINT"■THE WORLD IN HIGH RES. " POKE36879,128
20 FORI=0TO7 FORM=0TO7 POKE7706+M*22+I,I*8+M+64 POKE7714+M*22+I,I*8+M+128 NEXT
NEXT
25 POKE36869,254 FORI=6656TO7679 POKEI,0 NEXT
30 FORY=10TO59 READH IFH=0THENNEXTY
31 FORG=1TOH READJ READK FORX=JTOK GOSUB200 NEXTX NEXTG NEXTY DATA2,30,42,72,77
,3 24,24
40 DATA33 41 70 78 6,17 19,24,27 33,41,66 66,69 80,85 96,9,5,12,14,14 18,21,26,
28 34
50 DATA41,53 56 60 61,64 66,69 90,6,4,17,20,25,27,29,34 40,52,55,56,96,5,5,23,2
7,30
60 DATA34,29,42 43 51,37 5 4 23,23,23,34,37,41,43,50,95,5,4,22,27 28,35,36,49,5
4 54 93
70 DATA6 6 2 11 22 27 30 50 52 54,83 90 90,5 13,24 27,31,46,46,53,85,89,90,6,14
,18,27
80 DATA32 45 45 47 47 49 94,99,98,3 14,22,46,46 48 85 2,15,29,47,85,4,15,30,32,
42,47
90 DATA56 59 64 3 15 29,46 54 59,84,6,14 23,45,47,51,53 56,56,59,63,85,86,5,15,
28,45,46
100 DATA51,51,53 53,56,81,5,16 27,47,49 57,79 81,81,84,84,4,17,26,45,51,57,79,8
0,82
110 DATA2 19 25 45,79 5 18,22,26,26,44 56,58,68,63,79,4,19,22,43,56,58,62,66,79
,5 20,22
120 DATA26,27,43,56,59 62 66 78,5,21,24,43,57,59,61,67,69,72,75,4,22,25,43,57,6
7,58 73
130 DATA76,5,25,25,29,30,43,68,68,68,74,75,4,26,31,44,68,68,68,74,74,5,27,33,45
,47 49 59
140 DATA74,74 78 78,4 27,34,58,59,73,73,77,78 4 26,35,58,58,74,74,77,78,4,26,37
,49 57
150 DATA74,75,83,85,4,26,38 50 58,77,77,85,86,3,26,38,51,58,87,87,5,27,37,51,58
,60 68
160 DATA82,83,85,95,5 28,37 51,57,59,68,80,83,05,85,4,29,36,51,57,59,60,79,86,4
,29 35
170 DATA51,56 59 59,77,87,4,29,34,52,56,59,59,77,88,3,29,34,52,55,78,88,3,29,34
,53 54 78
180 DATA87,4,28,33,53,53,78,79,83,87,3,28,32,84,86,93,93,1,28,31,2,28,30,93,93,
2,28,30
190 DATA91,93 2,28 29,91,91,1,28,29,1,28,29,0,1,30,30
198 GETA$ IFA$=""THEN198
199 PRINT"■■■■■■■■" POKE36869,240 END
200 C%=INT(X/8)*8+INT(Y/8) R%=(Y/8-INT(Y/8))*8 B%=6656+8*C%+R% D%=7-(X-(INT(X/8
))*8)
210 POKEB%,PEEK(B%)OR(2↑D%) RETURN
```

World Map

by Gerhard Nath

Asteroid Lander

on BBC Micro

The object of the game is to plant your planet's flag on the planet Zaxon. Zaxon however has a moving asteroid belt close to its surface, which must be negotiated to achieve a safe landing. You must land in the centre of the landing pad, which is located at the right-hand side of the screen. If you do land, the flag will automatically drop from your ship's cargo hatch. You will then take off again, and you must reach the top of the screen to complete your mission safely. This program will run on a BBC microcomputer, model B.

Program notes

Lines	
90	Switches the cursor off
100	Sets up the asteroid positions
600 to 630	Makes a sound when you land.
660 to 850	Checks to see if you have hit an asteroid
890 to 930	Makes an explosion sound if you crash
1150 to 1370	Prints the instructions.
1960 to 2010	Moves the asteroids.

```
10 REM Asteroid Lander
20 REM by Philip Wells Age 10
30 REM For BBC Microcomputer Model B
40 [illegible]
50 PROCinstructions
60 [illegible]
70 [illegible]
80 MODE [illegible]
90 VDU 23;8202;0;0;0;
100 [illegible]
110 [illegible]
120 REM
130 COLOUR 4
140 [illegible]
150 [illegible]
160 [illegible]
170 FOR Z=1 TO 200
180 GCOL 0,RND(7)
190 PLOT 69,RND(1279),RND(1020)
200 NEXT Z
210 GCOL 0,3
220 FOR Z=1 TO 94
230 MOVE 0,Z
240 DRAW 1279,Z
250 NEXTZ
260 VDU 23,226,&FF,&FF,&FF,&FF,&FF,&FF,&FF,&FF
270 VDU 23,227,&FF,&FF,&FF,&FC,&F8,&F0,&E0,&C0
280 VDU 23,228,&FF,&FF,&FF,&3F,&1F,&0F,&07,&03
290 COLOUR 2:PRINTTAB(14,28);CHR$228CHR$226CHR$227
300COLOUR 3
310VDU 23,225,24,60,60,60,24,60,90,90
320X=10:Y=1
330COLOUR 1:PRINTTAB(X,Y);CHR$(225)
340A$=INKEY$(0)
350IF A$="Z" THEN PROCLEFT
360IF A$="X" THEN PROCRIGHT
370 IF Y=27 AND X=15 THEN PROCSUCC:GOTO 2030
380PRINTTAB(X,Y);" "
390 REM
400Y=Y+1 IF Y=27 AND X=14 OR Y=27 AND
X=16 THEN PROCTILT:PROCRASH:PROCGAME
410IF Y>27 AND X<>15 THEN PROCRASH
420 PROCMOVE
430 PROCHECK
440GOTO 330
450DEF PROCLEFT
460PRINTTAB(X,Y)" ":X=X-1
470IF X<=0 THEN X=X+1
480PRINTTAB(X,Y);CHR$225
490 PROCHECK
500GOTO 330
510ENDPROC
520DEF PROCRIGHT
530PRINTTAB(X,Y)" ":X=X+1
540IF X>=19 THEN X=X-1
550PRINTTAB(X,Y)CHR$225
560 PROCHECK
570GOTO 330
580ENDPROC
590DEF PROCSUCC
600FOR X%=1 TO 20
610SOUND 1,-12,30,1
620SOUND 1,-12,144,1
630NEXT X%
640ENDPROC
650DEF PROCHECK
660IF X=A AND Y=10 THEN PROCRASH
670IF X=B AND Y=11 THEN PROCRASH
680IF X=C AND Y=12 THEN PROCRASH
690IF X=D AND Y=13 THEN PROCRASH
700IF X=E AND Y=14 THEN PROCRASH
710IF X=F AND Y=15 THEN PROCRASH
720IF X=G AND Y=10 THEN PROCRASH
730IF X=H AND Y=11 THEN PROCRASH
740IF X=I AND Y=12 THEN PROCRASH
750IF X=J AND Y=13 THEN PROCRASH
760IF X=K AND Y=14 THEN PROCRASH
770IF X=L AND Y=15 THEN PROCRASH
780IF X=M AND Y=10 THEN PROCRASH
790IF X=N AND Y=11 THEN PROCRASH
800IF X=O AND Y=12 THEN PROCRASH
810IF X=P AND Y=13 THEN PROCRASH
820IF X=Q AND Y=14 THEN PROCRASH
830IF X=R AND Y=15 THEN PROCRASH
840 IF X=S AND Y=10 THEN PROCRASH
850IF X=T AND Y=11 THEN PROCRASH
860ENDPROC
870DEF PROCRASH
880 PRINTTAB(X,Y)
890SOUND 0,-15,6,20
900FOR I%=-15 TO 0
910SOUND 0,I%,6,3
920NEXT
930PROCGAME
940ENDPROC
950DEF PROCGAME
960 COLOUR 3
970CLS
980 IF Y=0 THEN PRINT"   WELL DONE.
YOU":PRINT:PRINT"
COMPLETED YOUR":PRINT:
PRINT"   MISSION SAFLY.":PRINT:PRINT
990PRINT" ANOTHER GAME (Y/N)"
1000A$=GET$
1010IF A$="Y" THEN RUN
1020IF A$<>"N" THEN GOTO 1000
```

```
1030CLS
1040END
1050ENDPROC
1060DEF PROCTIL
1070COLOUR 1
1080VDU 23,230,0,56,124,127,124,28,18,16
1090PRINTTAB(X,28)
1100PRINTTAB(X,28);CHR$230
1110ENDPROC
1120DEF PROCinstructions
1130CLS
1140PRINT
1150FOR ZZZZ=0 TO 1:PRINTTAB(10,
 ;CHR$141;CHR$131
 "ASTEROID LANDER" NEXT ZZZZ
1160PRINT
1170PRINT"As Captain of the SKYHAWK spaceship,"
1180PRINT"you must guide your craft through the"
1190PRINT"asteroids and plant on the planet Zaxon"
1200PRINT"your planet's flag. When - and if - you"
1210PRINT"land on the planet, the flag will"
1220PRINT"automatically drop from the cargo hold."
1230 PRINT"If you do succeed in planting the flag,"
1240PRINT"you then have to reach the top of the"
1250PRINT"screen without hitting an asteroid."
1260PRINT"You must land on the centre of the"
1270PRINT"green landing pad, which is located on"
1280PRINT"the right hand side of the screen."
1290PRINT"If you do not land in the centre of the"
1300PRINT"landing pad you will explode. If you"
1310PRINT"hit an asteroid you will also explode."
1320PRINT"Keys for moving your spacecraft are"
1330PRINT"as follows:"
1340PRINT
1350PRINTCHR$131"Z - LEFT                X - RIGHT"
1360PRINT
1370PRINTCHR$130"        PRESS ANY KEY TO START"
1380A$=GET$
1390ENDPROC
1400DEF PROCMOVE
1410 COLOUR 4
1420PRINTTAB(A,10)"    A=A-1:IF A<=0 THEN A=18
1430PRINTTAB(A,10);CHR$224
1440COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1450PRINTTAB(B,11)"    B=B-1:IF B<=0 THEN B=18
1460PRINTTAB(B,11);CHR$224
1470COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1480PRINTTAB(C,12)"    C=C-1:IF C<=0 THEN C=18
1490PRINTTAB(C,12);CHR$224
1500COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1510PRINTTAB(D,13)"    D=D-1:IF D<=0 THEN D=18
1520PRINTTAB(D,13);CHR$224
1530COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1540PRINTTAB(E,14)"    E=E-1:IF E<=0 THEN E=18
1550PRINTTAB(E,14);CHR$224
1560COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1570PRINTTAB(F,15)"  ":F=F-1:IF F<=0 THEN F=18
1580PRINTTAB(F,15);CHR$224
1590COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1600PRINTTAB(G,10)"  ":G=G-1:IF G<=0 THEN G=18
1610PRINTTAB(G,10);CHR$224
1620COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1630PRINTTAB(H,11)"   :H=H-1:IF H<=0 THEN H=18
1640PRINTTAB(H,11);CHR$224
1650COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1660PRINTTAB(I,12)"   I=I-1:IF I<=0 THEN I=18
1670PRINTTAB(I,12);CHR$224
1680COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1690PRINTTAB(J,13)"   :J=J-1:IF J<=0 THEN J=18
1700PRINTTAB(J,13);CHR$224
1710COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1720PRINTTAB(K,14)"   K=K-1:IF K<=0 THEN K=18
1730PRINTTAB(K,14);CHR$224
1740COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1750PRINTTAB(L,15)"   L=L-1:IF L<=0 THEN L=18
1760PRINTTAB(L,15);CHR$224
1770COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1780PRINTTAB(M,10)"   M=M-1:IF M<=0 THEN M=18
1790PRINTTAB(M,10);CHR$224
1800COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1810PRINTTAB(N,11)"   N=N-1:IF N<=0 THEN N=18
1820PRINTTAB(N,11);CHR$224
1830COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1840PRINTTAB(O,12)"   O=O-1:IF O<=0 THEN O=18
1850PRINTTAB(O,12);CHR$224
1860COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1870PRINTTAB(P,13)"   P=P-1:IF P<=0 THEN P=18
1880PRINTTAB(P,13);CHR$224
1890COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1900PRINTTAB(Q,14)"   Q=Q-1:IF Q<=0 THEN Q=18
1910PRINTTAB(Q,14);CHR$224
1920COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1930PRINTTAB(R,15)"   R=R-1:IF R<=0 THEN R=18
1940PRINTTAB(R,15);CHR$224
1950COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1960PRINTTAB(S,10)"   S=S-1:IF S<=0 THEN S=18
1970PRINTTAB(S,10);CHR$224
1980COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
1990PRINTTAB(T,11)"  :T=T-1:IF T<=0 THEN T=18
2000PRINTTAB(T,11);CHR$224
2010COLOUR 1:PRINTTAB(X,Y);CHR$225:COLOUR 4
2020ENDPROC
2030PROCFLAG
2040PROCCOUNT
2050COLOUR 1:COLOUR 128
2060PRINTTAB(X,Y);CHR$225
2070A$=INKEY$(0)
2080IF A$="Z" THEN PROCZ
2090IF A$="X" THEN PROCX
2100PROCMOVE
2110 PROCHECK
2120 PRINTTAB(X,Y)
2130Y=Y-1:IF Y<=0 THEN PROCSUCC:PROCGAME
2140GOTO 2050
2150DEF PROCZ
2160PRINTTAB(X,Y)"   X=X-1
2170IF X<=0 THEN X=X+1
2180PRINTTAB(X,Y);CHR$225
2190GOTO 2060
2200ENDPROC
2210DEF PROCX
2220PRINTTAB(X,Y)"   X=X+1
2230IF X>=19 THEN X=X-1
2240PRINTTAB(X,Y);CHR$225
2250GOTO 2060
2260ENDPROC
2270DEF PROCFLAG
2280COLOUR 1
2290VDU 23,240,&00,&80,&80,&F0,&F0,&F0,&F0,&FF
2300VDU 23,241,&F0,&F0,&F0,&F0,&80,&80,&80,&80
2310VDU 23,242,&80,&80,&80,&80,&F0,&F0,&F0,&F0
2320PRINTTAB(15,26);CHR$242
2330FOR ZZZ=1 TO 530:NEXT
2340PRINTTAB(15,26);
2350PRINTTAB(17,27);CHR$240
2360FOR ZZZ=1 TO 600:NEXT
2370PRINTTAB(17,27)
2380PRINTTAB(17,28);CHR$241
2390SOUND 1,-15,100,1
2400ENDPROC
2410DEF PROCCOUNT
2420CNT=9
2430COLOUR 3:COLOUR 130
2440PRINTTAB(12,25);CNT
2450REPEAT finishtime=TIME+100
2460REPEAT UNTIL TIME=finishtime
2470CNT=CNT-1:IF CNT<=0 THEN PRINTTAB(15,20)"  ":ENDPROC
2480GOTO 2440
2490ENDPROC
```

Asteroid Lander
by Philip Wells



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POC2

Save it for a rainy day

John Durst completes his article on memory saving techniques

Storing a character in the recognised ZX character code often uses a good many more bits than are required to store the actual information. For instance, the figure "1" has a code 29 — which is 0001 1101 in Binary. This uses five of the eight bits available, whereas you only *need* to code one bit, 0000 0001, which has the value "1".

By looking for these *values*, rather than the characters for each digit, you can always code for two digits in one byte and sometimes for three. There are 256 possible characters. So you can code "123456" as, "CHR$ 12, CHR$ 34, CHR$ 56" which only uses three bytes, instead of six. To get the number out of the code, you get the ZX to print the appropriate *Codes*.

But you run into a snag when you try a practical application like a telephone number. To ring *Popular Computing Weekly* you have to dial, "01 839 6835". If you code this as I've described above, you will probably come up with, "■B■"?■. But when you de-code it, you get 18396835. You have lost the spacing which makes the number easier to remember and, more importantly, you have lost the leading zero, so that the STD dialling is up the spout.

What we need is a system which will keep all the zeros and preserve the spaces in their proper place. In fact, we need a system which counts in 11s, rather than in 10s — digits 0 to 9 = 10, plus "space" = 11. We can still get two sets of digits into a single byte, because 11 × 11 is only 121, which is well within the limit of 256.

So much for the theory, but what about the practice? Well, Figure 3, lines 10 to 90 give a simple Basic program which will code the numbers and spaces into two halves of a single byte. The de-coding, once again, is more handily done with machine code as listed in figures 1 and 2.

The coding is split into two sections, because the first part is identical with the machine code given in last week's article. Its purpose is to locate the beginning of Z$ among the variables. You should have your coded number ready in Z$. The second part of the code will work out the number, spaces and all, and print it.

The first part of the code has been set up as a subroutine named *Findz$*. This subroutine is called at the beginning of the main *Usr* routine.

You will have to enter the machine code in columns 2, 3 and 4 exactly as listed, using the Hex loader I showed last week. Remember to allow enough blobs in the Line 1 Rem statement, to make room for the machine code. You should have at least 39.

Once you have entered the machine code, you can add lines 90 and 100 and Run the program. Enter the telephone number of your choice, press *Newline* and "Hey presto!" out comes the coded version of the number, with the de-coded number underneath.

In a practical program, you would probably store the coded numbers in an array. Then you would have to arrange to dig them out and get them into Z$ using a line such as *Let Z$ = B$ (J)*, immediately before the *Rand Usr* 16531.

If you want, you could incorporate the Mr & Mrs program given last week into the same block of machine code. To do this you should load another Cd 82 40 immediately after the 18 ED which will call the *Findz$* subroutine again. Follow this with the second half of last week's listing starting at 06 02 AF.

When you want to call this routine, you should use *Usr* 16553. You would then need 55 spaces in Line 1 Rem to make room for the machine code for the two programs.

CODING & DECODING A TELEPHONE NUMBER

```
4082   3E 5F         LD    A,0F
4084   01 FC FF      LD    BC,FFFC
4087   2A 14 40      LD    HL,(4014)
408A   2B            DEC   HL
408B   03            INC   BC
408C   BE            CP    (HL)
408D   20 FB         JR    NZ,408A
408F   23            INC   HL
4090   23            INC   HL
4091   23            INC   HL
4092   C9            RET
```

Fig 1 Subroutine: FINDZ$

```
4093   CD 82 40      CALL  4082   CALL FINDZ$
4096   06 02         LD    B,02
4098   AF            XOR   A
4099   ED 6F         RLD
409B   FE 00         CP    00
409D   28 02         JR     Z,40A1
409F   C6 1B         ADD   A,1B
40A1   D7            RST   10
40A2   10 F4         DJNZ  4098
40A4   0D            DEC   C
40A5   C8            RET    Z
40A6   23            INC   HL
40A7   18 ED         JR    4096
```

Fig 2 Decode & print Phone No: in Z$

```
   1 REM Y?" UNPLOT COPY E=RND"
■4 CLS 777TAN LN ■RND"■ GOSUB ?
 RETURN  C"LEN .NOT ( POKE ■COS
7/ GOSUB 2022222222222222222222
22
  10 DIM X$(12)
  20 INPUT X$
  30 FOR J=1 TO 12 STEP 2
  40 LET X=(10 AND X$(J)=" ")+(CO
DE X$(J)-27 AND X$(J)<>" ")
  50 LET Y=(10 AND X$(J+1)=" ")+(
CODE X$(J+1)-27 AND X$(J+1)<>" "
)
  60 LET X$(J/2+.5)=CHR$ (16*X+Y
)
  70 NEXT J
  80 LET Z$=X$( TO 6)
  90 PRINT Z$
 100 RAND USR 16531


>■?■■?
01 839 6835
```

Fig 3 BASIC program encodes 12 digit phone No: in 6 digits (in Z$)

Dwelling on Ragnarök

***John Scrivan** gives a few hints and tips on writing structured programs.*

Some of the points I am going to raise will no doubt irritate a number of you outrage a few, and unfortunately confuse others I hope that somewhere in the gloom this article may help you to think about the programs you write and at least prevent you from passing on your faults to others

Before I start there are two important points — (1) I have been guilty of most of the following faults myself and in moments of weakness still fall prey to them and (2) there are no such things as perfect programs, only those that suffice until a better version comes along

When writing a program, the first thing to do is switch off your computer go away and find yourself a piece of paper Naturally you need to know which computer you are writing for both its potential and limitations, but actually composing at the keyboard is not the best thing to do This is a terribly difficult habit to break and only became easy when I realised that I could sit in a pub or on the beach and continue to program

Sketch a rough design for the program on paper These questions may help — what is its purpose? Who will use it? Does it need instructions to run? Does it need graphics sound etc?

At this stage, it is a good idea to work out a flow of control through the program You do not need to use standard flow-chart symbols unless you wish to As an example, I will write a program to demonstrate to primary school-children how to build up a curve from straight lines (curve stitching, as it is more usually called)

RUN → INITIALISE → INSTRUCTIONS → MAIN PROG → REPEAT?

Attending to the needs of the user first is called the *Outside-In* approach (although many people do not use these rather fiendish terms you may come across them in text-books)

Now you need to sort out the flow of control in terms of line numbers then use them to help organise your program One way is to have a control module at say line 1000 and subroutines at, for instance 2000 3000 etc

Designing a program using a modular approach is often called the *Top-Down* method a term borrowed from psychology (Note that these methods are not mutually exclusive but that the best bits of each are combined)

In the example program, it produces a result like this —

```
1000 REM Control Module
1010 GOSUB 2000 REM Initialisation
1020 GOSUB 3000 REM Instructions
1030 GOSUB 4000Main Program
1040 GOSUB 5000 REM Repeat Option
1050 GOTO 1030 REM Repeat Chosen
```

In effect the program has now been written — it only need the subroutines to be filled in You may have subroutines that perform particular functions already on cassette, in which case it is comparatively simple to merge them with new programs If you do not happen to have any subroutines handy then it is necessary to sit down with some paper and work some out It is only at this stage that you need to switch on the computer and try them out

First the subroutine that handles initialisation If you state somewhere *Let A = X*, then you should have assigned a value to *X* previously Some machines assign a default value, usually Ø, to undefined variables but the Spectrum will produce an error message telling you at which line you have attempted to use the undefined variable

If you use a subroutine to initialise variables and also label them using Rem statements, rather than dot them about as and when they occur, you can see at a glance which ones you have used previously and what their purpose is It should be clear that you do not necessarily know these subroutines at the development stage of your program so set up the first line and add to it when ready

```
2000 REM Initialisation Module
2010 LET A = 1 etc
```

The curve stitching program needs no initialisation as such, so it can simply be used to set up the colours of the border, paper and ink etc

To design the main program module, try sketching a few lines on paper to show what the display should be like On a Spectrum, there are 256 × 176 points you can define, so a piece of graph paper with at least 26 × 18 squares may be a help

How will the display be built up? It is possible to define each line on the screen one at a time but this is wasteful on memory and hardly elegant If you know the starting position for each line and the step size it is better to use a *FOR – NEXT* loop Many programs that appear in magazines could be improved a great deal by use of loops A brief example of a character generator may suffice

```
10 POKE USR a 126
20 POKE USR a +1 56
30 POKE USR a +2 23
40 POKE USR a +3 45
50 POKE USR a +4 14
60 POKE USR a +5 10
70 POKE USR a +6 20
80 POKE USR a +7 126
```

```
10 FOR N=0 TO 7
20 READ X
30 POKE USR a +N X
40 NEXT N
50 DATA 126 56,23 45 14 10,20 126
```

The curve stiching main module can be trimmed by using a loop to generate lines from all four sides of the square at the same time Note that the program lines are spaced 10 lines apart Even on a machine with a renumbering facility, it is useful to be able to insert lines you need at a later stage

The repeat module is fairly simple If you offer someone the chance of restarting the program you can use an *Inkey$* function to check for a certain response from the keyboard This successfully error traps the user response — any other key press apart from *Break* is ignored

If this program is to be used by anyone apart from yourself it needs documentation ie notes on how to run the program what it does how to change it memory requirements etc This information can be on paper or it can be present in a limited form inside the program

As the program may be used by young

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```
  10 REM
  20 REM *CURVE STITCHING *
  30 REM
  40 REM © JOHN SCRIVEN 23/7/83
  50 REM
1000 REM ************************
1000 REM Control Module
1000 REM ************************
1010 GO SUB 2000  REM Initialisa
tion
1020 GO SUB 3000  REM  Instructi
ons
1030 GO SUB 4000  REM  Main Prog
ram
1040 GO SUB 5000  REM  Repeat Op
tion
1050 GO TO 1030  REM Repeat Chos
en
2000 REM ************************
2010 REM *Initialisation*
2020 REM ************************
2030 BORDER 7  PAPER 7  INK 1: C
LS
2040 RETURN
3000 REM ************************
3010 REM *Instructions*
3020 REM ************************
3040 PRINT AT 0,4,"***CURVE STI
TCHING***",AT 1,4,"============
==========="
3050 PRINT "     This program wil
l draw lines from each side of a
square to   adjacent sides. The
step size is the distance each li
ne is from  its neighbour. As ea
ch set is   completed, the squar
e will be   redrawn with the ste
p size      reduced by two."
3060 PRINT "     You will be able
 to see the curves become strong
er as the    lines get closer tog
ether."
3070 PRINT "     If you get tire
d of the     sound & colour, the
n delete     lines 4070 & 4110.
You can break the program at any
stage by     pressing CAPS SHIFT
 & SPACE and restart by pressing
 CONT then    ENTER"
3080 INPUT  "Press ENTER now to b
egin ",z$
3090 RETURN
4000 REM ************************
4010 REM *Main Program*
4020 REM ************************
4030 FOR z=30 TO 0 STEP -2
4040 IF z=0 THEN LET z=1
4050 CLS   PRINT AT 10,21,"STEP
",z
4060 REM
4070 INK z/6  REM *COLOUR*
4080 REM
4090 FOR n=0 TO 100 STEP z
4100 REM
4110 BEEP .01,n/4  REM *SOUND*
4120 REM
4130 PLOT 100-n,0  DRAW n,100-n
4140 PLOT 0,n  DRAW n,100-n
4150 PLOT n,100  DRAW 100-n,-n
4160 PLOT 0,n  DRAW 100-n,-n
4170 NEXT n
4180 PAUSE 200  NEXT z
4190 RETURN
5000 REM ************************
5010 REM *Repeat Option*
5020 REM ************************
5030 PRINT AT 18,21,"Press  "Y""
,AT 19,21," to repeat,",AT 20,21
,"  S   to stop"
5040 LET a$=INKEY$
5050 IF a$="Y" OR a$="y" THEN RE
TURN
5060 IF a$="S" OR a$="s" THEN ST
OP
5070 GO TO 5000
```

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children or people of limited experience I decided to make it auto running so it is saved using *Save* STITCH *Line* 1 The program will execute itself when it has finished loading and go straight to the instructions This method is useful on two counts — firstly it makes it easier for inexperienced users and secondly if you hold any information in variables or arrays, they are not lost accidently by using *Run*

When information is displayed on the screen, it is impossible to know how long the user will take to read and assimilate the display It is clearly then an unwise decision to specify a particular length of time to hold the display All that is necessary is a line such as —

```
INPUT "Press RETURN to continue" Z$
```

The last module the repeat option could be included in the main program but makes more sense as a separate module Instructions for key pressing should be specific rather than general ie it is better to say "Press "Y" to continue" than to say "Press any key" (on the Spectrum as well as many other machines, it is necessary to check for a lower case "y" as well as the upper case)

It can be seen in the listing that I have included the opportunity to *Stop* the program at this stage There is nothing more infuriating than discovering that the only way to escape is to pull out the mains plug

The program is now almost finished (sighs of relief) and a check through the listing should show how the flow of control operates The final touches are a title at the beginning and an author/date line Note that all Rem statements are nested between empty Rem lines eg

```
10 REM
20 REM "CURVE STITCHING"
30 REM
```

This does nothing more than to make the modules stand out

If you are interested in encouraging good programming practice or hope to go on to more structured languages like Pascal Comal or even BBC Basic you will find the leap into the unknown less painful by adopting a more systematic approach Since Dijkstra's famous article "*Goto* statement considered harmful" back in 1966, many people have commented on their over-use in Basic — OK so the program works but can you still see why a month later?

You may disagree with much that I have written, but I hope it will make you think next time you consider writing a program

Generating coded ends

We call this the *standard ending* So we might as well make the program generate this code at the end of the routine automatically Here's the loader in its simplest form (in 1K you can save memory by shortening the *Print* phrases)

```
10  PRINT "BASE ADDRESS □",
20  INPUT B
30  PRINT B
40  PRINT "NO OF DATA BYTES □",
50  INPUT D
60  PRINT D
70  FOR I = 0 TO D - 1
80  POKE B + I 0
90  NEXT I
100 LET A = B + D
110 PRINT "CODE "
120 INPUT C
130 IF C < 0 THEN GOTO 180
140 PRINT C
150 POKE A, C
160 LET A = A + 1
170 GOTO 120
180 CLS
190 FOR I = 1 TO 9
200 POKE I - 1 + A, M (I)
210 NEXT I
```

The last three lines assume that the array *M* has been set up in command mode (ie without line numbers) by

```
DIM M (9)
LET M (1) = 62
LET M (2) = 30
LET M (3) = 237
LET M (4) = 71
LET M (5) = 253
LET M (6) = 33
LET M (7) = 0
LET M (8) = 64
LET M (9) = 201
```

These are the standard "end of routine" codes mentioned earlier

Or, you could input these values into *M* using a *For* loop and then delete the loop before saving Either way do not forget to execute the program with *Goto* 10 and not Run, so that the array values are preserved

Now execute the program

```
220 LET Y = USR (B + D)
```

The *Y* value returned by *Usr* isn't usually needed but it has to be there to satisfy the syntax of the statement It actually contains whatever was in the Bc register pair on returning from the machine code routine

Finally, we look at the state of the program and its data

```
230 FOR I = B TO A + 8
240 PRINT I PEEK I
250 NEXT I
```

Now to run the program Firstly the machine code routine has to coexist with the Basic system If we're careless Basic will clobber our defenceless little routine because it's always moving things around in memory

One way out of this problem is to fool Basic into thinking that the top of memory is below where it really is, and use the resulting "attic" for any programs we want preserved To do this *Poke* the bytes 16388 and 16389 (which together form a system variable called *Ramtop*) with the address from which we wish to start our program In other words this is the first address which is unavailable to Basic As usual, the low byte contains the least significant value

So taking an example for a 1K machine, *Ramtop* contains the hex value 4400 to start with If we want to allocate a 256 (decimal) byte attic we have to set *Ramtop* to 4300

```
POKE 16388 0        [=00 hex]
POKE 16389 67       [=43 hex]
```

Incidentally, 4300 hex = 17152 decimal, and you can omit the *Poke* 16388 unless for some reason, you've changed it from its usual 0 value previously

Now we type *New* because Basic only notices that *Ramtop* has changed when *new* is executed Next, load the "loader" program and run it In response to its *base address* request, type 17152, and, to *No of data bytes*, type 1 Finally, key in the machine code (62, 4 6, 7 etc) terminating with a negative value — a delimiter that is ignored on loading but signalling "end of code listing"

The system responds by printing the contents of bytes from 17152 onwards In 17152 is 11 which is the sum of 4 and 7 This should not be surprising since that is where we asked to store the result and it's also the byte we allocated for data The rest of the "memory dump" just confirms that the program is correctly stored

Experiment by altering the values being added (just *Poke* new values into 17154 and 17156 and *goto* 220) Alternatively put the result somewhere else — say 17153 See how it changes the program?

If you have any machine code subroutines/tips/games, please send them to Machine Code, *Popular Computing Weekly*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF

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Temperament and the Dragon

Simon Owen looks at the pros and cons of being a Dragon owner.

This article is mainly dedicated to all those people who, like myself, spent hours hunched over that little black box — namely the ZX81, and who now own or are thinking of becoming owners of that miraculous if slightly temperamental creature — the Dragon 32

Oh, what a lovely sight that Dragon is too A real keyboard at last Much more thumping of the dead 'touch sensitive' one on the ZX81 and I would have had no finger ends left The high resolution graphics are super as well after those chunky 64 x 32 things

But — and it is a very large but at that — the manual which claims to be comprehensive certainly does not live up to its promise It is not a patch on the Sinclair one which is witty and very useful A first-time user would have a lot of difficulty making the machine do anything at all As it is, it took me ages to make any sense of it.

A week and a half and nearly a head of hair later, I read that this new animal of mine is really a well-known colour computer in Dragon s clothing With this information ringing in my brain I begged the money from Mum and off I dashed hot-foot, to the High Street to buy 'their manual I arrived home triumphant with this book, which at £3 95 was great value almost as good as the ZX81 s It covers in detail (a word I do not think the people at Dragon Data know) all the graphic and some of the string functions, except for two which still have me baffled — *Get* and *Put*

The first difference between our dear old 81s and the Dragon becomes obvious the minute you turn it on — the screen is smaller than we eighty-oners are used to, Another difference, and quite a good one (I think) is the *Print@* command instead of good old X and Y

When listing a long program the screen size can be a nuisence You have to be very quick to stop the listing going off the top of the screen However the *Renum* command is great All that time spent editing line numbers etc, can now be done in a second I had great fun with that one The *Edit* command which is a bit daunting at first (and which seems to have foiled several reviewers) can be very useful and time-saving once you get the hang of it And it is much more comprehensive than the edit capability of the ZX81

The colour commands which incidentally, I found quite hard to handle, have one large drawback The screen text can only be black on green or vice versa Although the screen can be *Cls*-ed any colour the text reverts back to black and green (at least it does for me — any advice to make it otherwise would be welcome) Also, if you use a black and white television as I have to most of the time the colours, which should show up as graduated shades of grey — don t

The only other major gripe I have about the Dragon has to do with the way that the character set is laid out Although there are approximately the same number of pixel characters as on the ZX81 they are reproduced eight times — each in a different colour This space could have been used for much more useful things user-defined characters or pre-defined high-res graphics to name but two Also the fact that these characters are not available through the keyboard but only by using *Chrs* makes programs considerably longer if you are using a lot of low res graphics

On the plus side is the fact that all the Dragon commands are amazingly fast compared with the time things take on the ZX81 Even the graphics commands *Line* and *Draw* are almost instantaneous and the circle command is superior to the equivalent on many of the more expensive micros

Dragon Data s software is not as good as I thought it was going to be There is not much of it, and what there is does not seem to exploit the machine as well as it could If you do not have any joysticks there is at least one of their programs you cannot use, but it does not tell you this anywhere on the outside of the packaging The price of the software seems high at £7 95 when you consider some of the really excellent ZX81 tapes for under a fiver

Although I seem to be criticising my Dragon a lot I am being a bit unfair The Dragon 32 with its 6809 microprocessor is a totally different type of computer to the ZX81 and most of my moans are more to do with this fact and my own inexperience than from any fault in the machine The opinion of others far wiser than myself seem to bear out my original impression that the Dragon really is a wonderfully powerful machine with terrific potential When other enthusiasts and the software houses discover the Dragon there will be ample information and lots of games to play When this happens I am sure that our Dragons will really prove their worth

Below are two small 'sample programs to amuse you The first produces circular patterns using height/width ratio in conjunction with a *For-next* loop The second uses the *Line* command to produce everlasting patterns — be warned this is quite hypnotic!

```
5   REM OVALS
10  CLS
20  INPUT "INCREMENT STEP (1-9)",A
30  INPUT "A NUMBER BETWEEN 1 & 3(DECIMALS TOO)",B
40  PMODE4 PCLS SCREEN 1,1
50  FOR X=1 TO 90 STEP A
60  CIRCLE (128,96),X,,B
70  NEXT X
80  A$=INKEY$ IF A$=""THEN 80
90  GOTO 10
```

```
1   REM PATTERNS
2   '
3   PMODE 3,1
10  PCLS3
15  SCREEN 1,0
20  FOR I=3 TO 7
25  FOR J=2 TO 6
30  FOR S=0 TO 3
35  FOR R=0 TO 3
40  COLOR R,S
45  A=0 B=255,C=0 D=191
50  LINE (A,C)-(B,D), PSET,B
55  A=A+J B=B-J C=C+I D=D-I
60  IF A<255 AND C<191 THEN 50
65  NEXT R
70  NEXT S
75  NEXT J,I
80  GOTO 30
```

Is there anything about your computer you don't understand, and which everyone else seems to take for granted? Whatever your problem *Peek* it to Ian Beardsmore and every week he will *Poke* back as many answers as he can. The address is *Peek & Poke, PCW*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

INTERROGATION ENGLISH STYLE

R Watson of Washington, Tyne and Wear, writes

Q **Do you know of any way in which tokenised line numbers and commands in the BBC model B program can be converted into English for interrogation and edit aid?**

A This can be done if you load the accumulator with the token that you want to be printed When this is done call the address B53A (hex) The computer will decrunch the token into *Ascii* and then print out the *Ascii*

ACE GOES BACK TO SCHOOL

Joe Laine of Yew Road Stockport, writes

Q **I am very interested in the new Jupiter Ace, but I am unsure whether or not to buy it I was going to get a ZX81 or Spectrum to learn on, because I am going to start learning computing at school soon What I want to know is, will I have to learn two languages, one at school and one on a Jupiter Ace? Also will there be software coming out for the Ace? I do not want to buy a computer that has no software.**

A The Jupiter Ace has caused quite a lot of interest, and not a small amount of decision taking It is not an easy choice to make if you want to buy a computer, even if you do believe that Forth is a better language than Basic

What you say about school is very important I know that last year the London Board specified any high level language for the O-level but only Basic for the A-level This year the AEB has not specified Basic only The thing to do in this case is to talk with your teachers find out what the syllabus asks and what they are going to teach While an increasing number of staff are becoming computer literate, I doubt if many of them are conversant with Forth

I feel that it is a very good choice for a second machine As to whether you should make it your first choice — I would again suggest you talk to your teachers before deciding

BASTARDISING BASIC

D G Callow of Hamilton Crescent, Brentwood Essex, writes

Q **I hope that your series on machine code is going to be as helpful as it looks I wonder if you could clear up the following points for me**

(a) Why do authors attach so much importance to safeguarding machine code by placing it in a Rem statement, or above Ramtop? After all, I am not going to press *New* until I have finished with the program

(b) Why is a machine code program so often supplemented by a Basic program. Why cannot the whole program be written in machine code?

(c) Why is it that, having *Loaded* a machine code program, a Basic program then disappears?

(d) Machine code is typically *Run* by a *Rand Usr* address, but why on earth is *Randomize* necessary?

(e) With all due respect to Messers Stewart and Jones, why do you write a program in Hex, when as part of the *Loading* process it is converted to decimal. Why not write the program in decimal in the first place?

A The reason machine code is placed in either a Rem statement, or above Ramtop, is that the memory locations within a program move As new information is put in or changed, the addresses of the various items within the program change as well This does not really matter in the execution of a straightforward program But when there is a machine code routine to be called the computer must know where it is The first line of a program, or the space above Ramtop are fixed, and therefore safe places to store such a routine

When you switch on a computer, the Rom takes over and offers you control Because the Rom is in Basic, the control is in Basic On the ZX81 machine code can only be 'entered' by commands from the Basic The second reason for mixing machine code with Basic is that machine code is a lot harder to debug So, there is often an element of compromise, as it makes fault finding so much easier to identify and correct

When you use the *Usr* command it also clears the screen This is why your basic will disappear

Rand is used because it is a one byte command and relatively harmless in that all it does is to reset the seed generator Because of the way the ZX81 is configured, *Usr* cannot be called on its own *Print* could be used, except that it will clear the screen when used with *Usr*, which might not be wanted *Poke* can also be used, but that starts changing locations *Rand* is safe and uses the minimum of memory

The reason that hex is used so often is that it is much simpler All the addresses from 0 to 65535 can be represented in hex by just four characters It is also much easier for a computer to convert hex to binary, and vice versa, than it is to convert either of those two to denary

It is a legacy from the days when computers only had a hex keypad, because of space restrictions (who remembers the Sinclair Mk 14 complete with 256 bytes of Ram and delivery problems?) Also because there are fewer digits to input, it is quicker to input hex

COMMON CADS UP MARKET

Paul Mottram of Brompton, London SW5, writes

Q **I have seen written down sometimes the words CAD and CAM. I'm sure that they are initials for something but cannot work out what. Can you tell me.**

A CAD is Computer Aided Design, and CAM is Computer Aided Management They are words that are very common further up the business end of the market The most famous examples of CAD are the framework graphics that can be rotated in all directions whilst maintaining their true perspective.

CAM is more concerned with financial analysis, long-term planning and marketing Indeed it would cover most of the work that is dealt with by middle and senior management

SWITCHING OUT ON MEMORY

Tony De Souza of Elspeth Road, London SW11, writes

Q **After reading your answer in the September 23 issue, about the 80K extension for the Spectrum, I thought I had my questions answered. However, a couple of extra questions have come to mind.**

Can I retain the memory that is switched out? And can other hardware still be used, or will it interfere with the expansion? Would it be possible to review the expansion?

Also my Spectrum has a Nand gate wired in, presumably to clear up a problem. Can you tell me what that bug is or was?

A You can retain the memory of the 'switched out' 32K There is no Interference as such from the board as it is an internal fitting However, the board does have two Leds that stick out the back I doubt they will stick out enough to interfere with anything that is interfaced to the user port

The problem that does seem to have occurred is with the actual amount of memory that is switched out This is done in two 32K blocks, which are somewhat large Also it means that when you switch out a block your variables and display file go with it It would seem that some software for downloading the files from the top of the memory to the bottom is needed I do not at the moment know if this is being done

As to your last point, if you look at issues 6 and 9 of *Popular Computing Weekly* you will find out that in the original Spectrum pcbs, there was a shared data bus that caused a lot of problems

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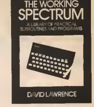
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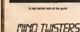
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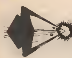
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